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What is claimed is:

- 1 1. A rewritable optical recording medium comprising
- 2 a substrate having a wobble groove, and a phase-change
- 3 recording layer, wherein a crystal state of the recording
- 4 layer is an unrecorded or erased state and an amorphous state
- 5 of the recording layer is a recorded state, and amorphous
- 6 marks corresponding to the recorded state are formed by
- 7 recording light,
- 8 after an EFM-modulated signal is recorded by an
- 9 overwriting operation ten times in the recording layer at
- 10 an the 8-times velocity V as high as eight times of a
- 11 reference velocity (1-times velocity) V_1 , which is a linear
- 12 velocity of 1.2 m/s, with a data reference clock period T
- 13 retained so as to satisfy $VT = V_1 T_1$ (where T_1 is 231 ns) under
- 14 one selected from various conditions of the following
- 15 recording method 1:
- 16 a modulation m_{11} of an eye pattern of the recorded
- 17 signal obtained as retrieved at the 1-times velocity is
- 18 60-80%,
- 19 a topmost level R_{top} of reflectivity of the eye pattern
- 20 of the recorded signal obtained as retrieved at the 1-times
- 21 velocity is 15-25%, and
- 22 a jitter of the individual length of marks and
- 23 inter-marks obtained as retrieved at the 1-times velocity
- 24 are equal to or less than 35 ns; and
- 25 said recording method 1 is carried out by exposing the

26 recording layer to recording light of a 780 nm wavelength
27 via an optical system whose numerical aperture (NA) is 0.55
28 or 0.5, with the time length of the individual amorphous
29 mark being nT (n is an integer within a range of from 3 through
30 11), in the following manner:

31 during that time, erasure power P_e , which is able to
32 crystallize the individual amorphous-state portions,
33 irradiates inter-mark portions between the individual
34 recorded marks,

35 for the recorded marks, the time length $(n-j)T$ is
36 divided into $\alpha_1T, \beta_1T, \alpha_2T, \beta_2T, \dots, \alpha_mT, \beta_mT$ (where $m=n-1$,
37 $\alpha_1=1.0, \alpha_i=0.5$ (i is an integer selected from 2 through
38 m), $\beta_m=$ from 0.25 to 0.75, $\alpha_i+\beta_{i-1}=1.0$ (i is an integer within
39 a range of from 2 to m)) in this sequence so as to satisfy
40 $\sum_i(\alpha_i+\beta_i)=n-j$ (j is a real number within a range of from 0
41 to 2.0),

42 within the time length α_iT (i is an integer within a
43 range from 1 to m), the recording light, whose record power
44 P_w is enough to melt said recording layer, irradiates the
45 recording layer (where P_w is 14 to 25 mW and $P_e/P_w=0.5$),
46 and

47 within the time length β_iT (i is an integer within a
48 range of from 1 to m), the recording light of bias power
49 P_b of 0.8 mW irradiates to the recording layer.

1 2. A rewritable optical recording medium comprising
2 a substrate having a wobble groove, and a phase-change

3 recording layer, wherein a crystal state of the recording
4 layer is an unrecorded or erased state and an amorphous state
5 of the recording layer is a recorded state, and amorphous
6 marks corresponding to the recorded state are formed by
7 recording light

8 after an EFM-modulated signal is recorded by an
9 overwriting operation ten times in the recording layer at
10 a 10-times velocity V as high as 10 times of a reference
11 velocity (1-times velocity) V_1 , which is a linear velocity
12 of 1.2 m/s, with a data reference clock period T retained
13 so as to satisfy $VT=V_1T_1$ (where T_1 is 231 ns) under one
14 selected from various conditions of the following recording
15 method 1',

16 a modulation m_{11} of an eye pattern of the recorded
17 signal obtained as retrieved at the 1-times velocity is
18 60-80%,

19 a topmost level R_{top} of reflectivity of the eye pattern
20 of the recorded signal obtained as retrieved at the 1-times
21 velocity is 15-25%, and

22 a jitter of the individual length of amorphous marks
23 and inter-marks obtained as retrieved at the 1-times
24 velocity are equal to or less than 35 ns; and

25 said recording method 1' is carried out by exposing
26 the recording layer to recording light of a 780 nm wavelength
27 via an optical system whose numerical aperture (NA) is 0.55
28 or 0.5, with the time length of the individual amorphous
29 mark being nT (n is an integer within a range of from 3 to

30 11), in the following manner:

31 during that time, erasure power P_e , which is able to
32 crystallize the individual amorphous-state portions,
33 irradiates inter-mark portions between the individual
34 recorded marks,

35 for the recorded marks, the time length $(n-j)T$ is
36 divided into α_1T , β_1T , α_2T , β_2T , ..., α_mT , β_mT (where $m=n-1$,
37 $\alpha_1=1.0$, $\alpha_i=0.5$ (i is an integer within a range of from
38 2 to m), β_m = from 0.25 to 0.75, $\alpha_i+\beta_{i-1}=1.0$ (i is an integer
39 within a range of from 2 to m)) in this sequence so as to
40 satisfy $\sum_1(\alpha_i+\beta_i)=n-j$ (j is a real number within a range of
41 from 0 to 2.0),

42 within the time length α_iT (i is an integer within a
43 range of from 1 to m), the recording light, whose record
44 power P_w is enough to melt said recording layer, irradiates
45 the recording layer (where P_w is 14 to 25 mW and $P_e/P_w=0.5$),
46 and

47 within the time length β_iT (i is an integer within
48 a range of from 1 to m), the recording light of bias power
49 P_b of 0.8 mW irradiates the recording layer.

1 3. A rewritable optical recording medium according
2 to claim 1 or 2, wherein

3 after an EFM-modulated signal is recorded by an
4 overwriting operation ten times in the recording layer at
5 a 4-times velocity V as high as 4 times of a reference
6 velocity (1-times velocity) V_1 , which is a linear velocity

7 of 1.2 m/s, with a data reference clock period T retained
8 so as to satisfy $VT=V_1T_1$ (where T_1 is 231 ns) under one
9 selected from various conditions of the following recording
10 method 2,

11 a modulation m_{11} of an eye pattern of the recorded
12 signal obtained as retrieved at the 1-times velocity is
13 60-80%,

14 a topmost level R_{top} of reflectivity of the eye pattern
15 of the recorded signal obtained as retrieved at the 1-times
16 velocity is 15-25%, and

17 a jitter of the individual amorphous marks and
18 inter-marks obtained as retrieved at the 1-times velocity
19 are equal to or less than 35 ns;

20 said recording method 2 is carried out by exposing the
21 recording layer to recording light of a 780 nm wavelength
22 via an optical system whose numerical aperture (NA) is 0.55
23 or 0.5, with the time length of the individual amorphous
24 mark being nT (n is an integer within a range of from 3 to
25 11), in the following manner:

26 during that time, erasure power P_e , which is able to
27 crystallize the individual amorphous-state portions,
28 irradiates inter-mark portions between the individual
29 recorded marks,

30 for the recorded marks, the time length $(n-j)T$ is
31 divided into α_1T , β_1T , α_2T , β_2T , ..., α_mT , β_mT (where $m=n-1$,
32 $\alpha_1=1.0$, α_i = from 0.3 to 0.6 (i is an integer within a range
33 of from 2 to m), β_m = from 0.25 to 0.75, $\alpha_i+\beta_{i-1}=1.0$ (i is an

34 integer within a range of from 2 to m)) in this sequence
35 so as to satisfy $\sum_i(\alpha_i+\beta_i)=n-j$ (j is a real number within
36 a range of from 0 to 2.0),

37 within the time length $\alpha_i T$ (i is an integer within a
38 range of from 1 to m), the recording light, whose record
39 power P_w is enough to melt said recording layer, irradiates
40 the recording layer (where P_w is 14 to 25 mW and $P_e/P_w=0.5$),
41 and

42 within the time length $\beta_i T$ (i is an integer within a
43 range of from 1 to m), the recording light of bias power
44 P_b of 0.8 mW irradiates the recording layer.

1 4. A rewritable optical recording medium according
2 to claim 1 or 2, wherein

3 after an EFM-modulated signal is recorded by an
4 overwriting operation ten times in the recording layer at
5 a 4-times velocity V as high as 4 times of a reference
6 velocity (1-times velocity) V_1 , which is a linear velocity
7 of 1.2 m/s, with a data reference clock period T retained
8 so as to satisfy $VT=V_1 T_1$ (where T_1 is 231 ns) under one
9 selected from various conditions of the following recording
10 method 3,

11 a modulation m_{11} of an eye pattern of the recorded
12 signal obtained as retrieved at the 1-times velocity is
13 60-80%,

14 a topmost level R_{top} of reflectivity of the eye pattern
15 of the recorded signal obtained as retrieved at the 1-times

16 velocity is 15-25%, and

17 a jitter of the individual amorphous marks and
18 inter-marks obtained as retrieved at the 1-times velocity
19 are equal to or less than 35 ns;

20 said recording method 3 is carried out by exposing the
21 recording layer to recording light of a 780 nm wavelength
22 via an optical system whose numerical aperture (NA) is 0.55
23 or 0.5, with the time length of the individual amorphous
24 mark being nT (n is an integer within a range of from 3 to
25 11), in the following manner:

26 during that time, erasure power P_e , which is able to
27 crystallize the individual amorphous-state portions,
28 irradiates inter-mark portions between the individual
29 recorded marks,

30 for the recorded marks, the time length $(n-j)T$ is
31 divided into α_1T , β_1T , α_2T , β_2T , ..., α_mT , β_mT (where $m=n-1$,
32 $\alpha_1=0.4$, α_i = from 0.15 to 0.25 (i is an integer within a
33 range of from 2 to m), β_m = from 0.25 to 0.75, $\alpha_i+\beta_{i-1}=1.0$ (i
34 is an integer within a range of from 2 to m)) in this sequence
35 so as to satisfy $\sum_i(\alpha_i+\beta_i)=n-j$ (j is a real number within
36 a range of from 0 to 2.0),

37 within the time length α_iT (i is an integer within a
38 range of from 1 to m), the recording light, whose record
39 power P_w is enough to melt said recording layer, irradiates
40 the recording layer (where P_w is 14 to 25 mW and $P_e/P_w=0.5$),
41 and

42 within the time length β_iT (i is an integer within a

43 range of from 1 to m), the recording light of bias power
44 Pb of 0.8 mW irradiates the recording layer.

1 5. A rewritable optical recording medium according
2 to claim 1 or 2, wherein said phase-change recording layer
3 comprises an alloy composition containing an excessive
4 amount of Sb as compared to a eutectic composition of SbTe.

1 6. A rewritable optical recording medium according
2 to claim 1 or 2, wherein said modulation m_{11} retains 90% or
3 more of its initial value after the lapse of 500 hours under
4 an acceleration test environment of a temperature of 80°
5 C and a relative humidity of 85%.

1 7. A rewritable optical recording medium according
2 to claim 1 or 2, wherein said recording medium includes,
3 on the wobble-grooved substrate, a lower protective layer,
4 a phase-change recording layer, an upper protective layer,
5 and a reflective layer, said phase-change recording layer
6 comprising one selected from the compositions represented
7 by $M_zGe_y(Sb_xTe_{1-x})_{1-y-z}$ (where $0 \leq z \leq 0.1$, $0 < y \leq 0.1$, $0.72 \leq x \leq$
8 0.8 , and M is at least one element selected from the group
9 consisting of In, Ga, Si, Sn, Pb, Pd, Pt, Zn, Au, Ag, Zr,
10 Hf, V, Nb, Ta, Cr, Co, Bi, O, N, S and rare earth metal
11 elements).

1 8. A rewritable optical recording medium according

2 to claim 7, wherein a crystal phase of the crystal state
3 comprises a single-phase or a multi-phase structure having
4 a face-centered cubic structure.

1 9. A rewritable optical recording medium according
2 to claim 1, wherein in the recording at the 8-times velocity,
3 after a single-period signal composed of a 3T mark
4 (having a time length of 3T where T is a data reference clock
5 period), and a 3T space portion (inter-mark portion having
6 a time length of 3T) is recorded,
7 another single-period signal composed of an 11T mark
8 (having a time length of 11T) and an 11T space portion
9 (inter-mark portion having a time length of 11T) is
10 overwritten in such a manner that the 3T mark is erased at
11 an erase ratio of 25 dB or higher.

1 10. A rewritable optical recording medium according
2 to claim 2, wherein in the recording at the 1the 2-times
3 velocity,
4 after a single-period signal composed of a 3T mark
5 (having a time length of 3T where T is a data reference clock
6 period), and a 3T space portion (inter-mark portion having
7 a time length of 3T) is recorded,
8 another single-period signal composed of an 11T mark
9 (having a time length of 11T) and an 11T space portion
10 (inter-mark portion having a time length of 11T) is
11 overwritt n in such a manner that the 3T mark is erased in

12 an erase ratio of 25 dB or higher.

1 11. A rewritable optical recording medium according
2 to claim 7, wherein said phase-change recording layer is
3 a film having a thickness selected from the range of 10
4 through 30 nm.

1 12. A rewritable optical recording medium according
2 to claim 7, wherein said lower protective layer is a film
3 having a thickness selected from the range of 50 through
4 150 nm.

1 13. A rewritable optical recording medium according
2 to claim 7, wherein said upper protective layer is a film
3 having a thickness selected from the range of 30 through
4 60 nm.

1 14. A rewritable optical recording medium according
2 to claim 7, wherein said reflective layer is a film having
3 a thickness selected from the range of 40 through 300 nm.

1 15. A rewritable optical recording medium according
2 to claim 7, wherein said phase-change recording layer
3 comprises one selected from the compositions represented
4 by $A^1_a A^2_b \text{Ge}_c (\text{Sb}_d \text{Te}_{1-d})_{1-a-b-c}$ (where $0 < a \leq 0.1$, $0 < b \leq 0.1$, $c < b < a$,
5 $0.02 < c \leq 0.2$, $0.72 \leq d \leq 0.8$, and A^1 is at least one element
6 selected from the group consisting of Zn, Pd, Pt, V, Nb, Ta,

7 Cr, Co, Si, Sn, Pb, Bi, O, N, S and rare earth metal elements,
8 and A² is at least one element selected from the group
9 consisting of Ga and In).

1 16. A rewritable optical recording medium according
2 to claim 7, wherein said reflective layer comprises one
3 selected from the group consisting of Al alloys and Ag
4 alloys.

1 17. A rewritable optical recording medium according
2 to claim 7, wherein said wobble groove has a wobble signal,
3 whose frequency is modulated by ± 1 kHz according to ATIP
4 (absolute time in pre-groove) information with a carrier
5 frequency of approximately 22.05 kHz in terms of the
6 frequency at the 1-times velocity of 1.2 m/s, said ATIP
7 information including at least one of an optimum recording
8 power Pw_0 , an optimum erasure power Pe_0 , an optimum bias power
9 Pd_0 and a divided-pulse information in accordance with the
10 recording linear velocity.

1 18. A rewritable optical recording medium according
2 to claim 7, wherein said wobble groove has a wobble signal,
3 whose frequency is modulated by ± 1 kHz according to on ATIP
4 information with a carrier frequency of approximately 22.05
5 kHz in terms of the frequency at the 1-times velocity, and
6 also has clock marks arranged along said wobble groove at
7 a repeating frequency in a range of from 2 to 8 times of

8 22.05 kHz.

1 19. A rewritable optical recording medium according
2 to claim 7, wherein said wobble groove has a wobble signal,
3 whose frequency is constant when the linear velocity is
4 constant, and has address information and a synchronization
5 pattern in terms of whether the wobble is modulated in phase
6 or whether a specified position is devoid of wobble.

1 20. A method of recording EFM-modulated information
2 in terms of different mark lengths on a rewritable
3 disc-shaped optical recording medium having a phase-change
4 recording layer by CLV (constant linear velocity) operation,
5 said method being carried out in the following manner:
6 when an individual recorded mark has a time length nT
7 (T is the data reference clock period, and n is an integer
8 within a range of from 3 to 11),
9 recording light of erasure power P_e , which is able to
10 crystallize an amorphous-state portion, irradiates
11 inter-mark portions,
12 for the recorded marks, the time length $(n-j)T$ is
13 divided into α_1T , β_1T , α_2T , β_2T , ..., α_mT , β_mT (where $m=n-$
14 1 or $m=n-2$) in this sequence so as to satisfy $\sum_1(\alpha_i+\beta_i)=n-j$
15 (j is a real number within a range of $0.0 \leq j \leq 2.0$), and
16 the recording light of recording power P_w ($P_w > P_e$),
17 which is able to melt the recording layer within the time
18 length α_iT ($1 \leq i \leq m$), irradiates the recording layer, and

19 the recording light of bias power P_b ($0 < P_b \leq 0.5 P_e$) within
20 the time length $\beta_i T$ ($1 \leq i \leq m$) the recording layer to
21 overwrite; and

22 when a linear velocity within a range of 1.2 m/s to
23 1.4 m/s is the reference velocity (1-times velocity) and
24 231 nsec (ns) is a reference clock period,

25 (1) for the 4-times velocity, $\alpha_i =$ from 0.3 to 1.5,
26 $\alpha_i =$ from 0.2 to 0.7 ($2 \leq i \leq m$), $\alpha_i + \beta_{i-1} =$ from 1 to
27 1.5 ($3 \leq i \leq m$),

28 (2) for the 1- or the 2-times velocity, $\alpha_i =$ from 0.05
29 to 1.0, $\alpha_i =$ from 0.05 to 0.5 ($2 \leq i \leq m$), $\alpha_i + \beta_{i-1} =$
30 from 1 to 1.5 ($3 \leq i \leq m$), and

31 (3) for any of 6-, 8-, 10- and 12-times velocities,
32 $\alpha_i =$ from 0.3 to 2, $\alpha_i =$ from 0.3 to 1 ($2 \leq i \leq m$),
33 $\alpha_i + \beta_{i-1} =$ from 1 to 1.5 ($3 \leq i \leq m$).

1 21. A recording method according to claim 20, wherein
2 for any of the described linear velocity in use,

3 m is constant,

4 $\alpha_i =$ approximately 1, $\alpha_i =$ from 0.3 to 0.6 (where i is
5 an integer within a range of from 2 to m), and

6 $\alpha_i + \beta_{i-1}$ is constant (where i is an integer within a range of
7 from 3 to m), and

8 α_i is monotonically reduced for the lower linear
9 velocity (where i is an integer within a range of from 2
10 to m).

1 22. A recording method according to claim 20, wherein
2 for any of the described linear velocity in use,
3 m is constant, and
4 each of $\alpha_i T$, $\alpha_i T$, and $\alpha_i + \beta_{i-1}$ is constant (where i is
5 an integer within a range of from 3 to m).

1 23. A recording method according to claim 21, wherein
2 for any of the described linear velocity in use,
3 m is constant, and
4 $\alpha_i + \beta_{i-1} =$ approximately 1 for every i (where i is an
5 integer within a range of from 2 to m).

1 24. A recording method according to claim 23, wherein
2 $\alpha_i / \alpha_1 =$ from 0.3 to 0.7 (where i is an integer within a range
3 of from 2 to m).

1 25. A recording method according to claim 20, wherein
2 for any of the described linear velocity in use,
3 $\beta_m =$ from 0 to 1.5, and
4 β_m is constant for every linear velocity, or is
5 increased more for the lower linear velocity.

1 26. A recording method according to claim 20, wherein
2 for any of the described linear velocity in use, each of
3 $\alpha_i T$ ($1 \leq i \leq m$) and $\beta_i T$ ($1 \leq i \leq m-1$) is 10 ns or more.

1 27. A method of recording various mark and inter-

2 mark lengths in terms of EFM-modulated information on a
3 rewritable disc-shaped optical recording medium having a
4 predetermined recording area by CAV (constant angular
5 velocity) operation, in which the recording medium is
6 rotated at a constant angular velocity, said method being
7 carried out in the following manner:

8 when a linear velocity within a range of from 1.2 m/s
9 to 1.4 m/s is a reference velocity (1-times velocity), the
10 disc-shaped optical recording medium is rotated in a way
11 that a linear velocity at an outermost periphery of the
12 recording area is as high as 10 times of the reference
13 velocity,

14 if a time length of an individual recorded mark is nT
15 (T is a data reference clock period varying according to
16 its radial position in a way that a product VT (V is a linear
17 velocity in the radial position) is constant, and n is an
18 integer within a range of from 3 to 11),

19 recording light of erasure power P_e , which is able to
20 crystallize an amorphous-state portion, irradiates
21 inter-mark portions,

22 for the recorded marks, the time length $(n-j)T$ is
23 divided into $\alpha_1 T, \beta_1 T, \alpha_2 T, \beta_2 T, \dots, \alpha_m T, \beta_m T$ (where $m=n-1$,
24 $\alpha_1 =$ from 0.75 to 1.25, $\alpha_i =$ from 0.25 to 0.75 ($2 \leq i \leq m$),
25 $\alpha_i + \beta_{i-1} =$ from 1 to 1.5 ($3 \leq i \leq m$)) in this sequence so as to
26 satisfy $\sum_1 (\alpha_i + \beta_i) = n-j$ (j is a real number within a range of
27 $0.0 \leq j \leq 2.0$),

28 within the time length $\alpha_i T$ ($1 \leq i \leq m$), the recording

29 light, whose record power P_w ($P_w > P_e$) is enough to melt said
30 recording layer, irradiates the recording layer, and within
31 the time length $\beta_i T$ ($1 \leq i \leq m$), the recording light of bias
32 power P_b ($0 < P_b \leq 0.5 P_e$) irradiates the recording layer, and
33 each of α_i and $\alpha_i + \beta_{i-1}$ ($i =$ from 3 to m) is constant for
34 any radial position, and α_i ($i =$ from 3 to m) is reduced
35 monotonically for the radially inner position.

1 28. A method of recording various mark and inter-
2 mark lengths in terms of EFM-modulated information on a
3 rewritable disc-shaped optical recording medium having a
4 predetermined recording area by CAV (constant angular
5 velocity) operation, in which the recording medium is
6 rotated at a constant angular velocity, said method being
7 carried out in the following manner:

8 when a linear velocity within a range of from 1.2 m/s
9 to 1.4 m/s is a reference velocity (1-times velocity), the
10 disc-shaped optical recording medium is rotated in a way
11 that a linear velocity at an outermost periphery of the
12 recording area is as high as 10 times of the reference
13 velocity,

14 if a time length of an individual recorded mark is nT
15 (T is a data reference clock period varying according to
16 its radial position in a way that a product VT (V is a linear
17 velocity in the radial position is constant, and n is an
18 integer within a range of from 3 to 11),

19 recording light of erasure power P_e , which is able to

20 crystallize an amorphous-state portion, irradiates
 21 inter-mark portions,
 22 for the recorded marks, the time length $(n-j)T$ is
 23 divided into $\alpha_1T, \beta_1T, \alpha_2T, \beta_2T, \dots, \alpha_mT, \beta_mT$ (where $m=n-$
 24 $1, \alpha_i/\alpha_1 =$ from 0.3 to 0.7 (i is an integer within a range
 25 of from 2 to m), $\alpha_i+\beta_{i-1} =$ approximately 1 ($3 \leq i \leq m$)) in this
 26 sequence so as to satisfy $\sum_i(\alpha_i+\beta_i)=n-j$ (j is a real number
 27 within a range of $0.0 \leq j \leq 2.0$),
 28 within the time length α_iT ($1 \leq i \leq m$), the recording
 29 light, whose record power P_w ($P_w > P_e$) is enough to melt said
 30 recording layer, irradiates the recording layer, and within
 31 the time length β_iT ($1 \leq i \leq m$), the recording light of bias
 32 power P_b ($0 < P_b \leq 0.5P_e$) irradiates the recording layer, and
 33 each of α_iT ($i =$ from 2 to m) and $\alpha_i+\beta_{i-1}$ ($i =$ from 3 to
 34 m) is constant for any radial position.

1 29. A recording method according to claim 27 or 28,
 2 wherein said recording area is divided into a plurality of
 3 virtual zones for every radial position, $\beta_m =$ from 0 to 1.5,
 4 and β_m is monotonically increased for the radially inner
 5 zone.

1 30. A recording method according to claim 27 or 29,
 2 wherein said rewritable disc-shaped optical recording
 3 medium is a rewritable compact disc (CD-RW) in which at least
 4 an radius ranging from 23 to 58 mm is defined as said
 5 recording area.

1 31. A recording method according to claim 27 or 28,
2 wherein each of $\alpha_i T$ ($1 \leq i \leq m$) and $\beta_i T$ ($1 \leq i \leq m$) is 10 ns or
3 more for any radial position.

1 32. A recording method according to claim 27 or 31,
2 wherein for any linear velocity in use, a value of each of
3 Pb, Pw, and Pe/Pw is substantially constant.

1 33. A recording method according to claim 27 or 28,
2 wherein

3 said rewritable disc-shaped optical recording medium
4 has on a substrate a wobble groove having a wobble signal
5 whose frequency is modulated by a starrering of ± 1 kHz
6 according to ATIP (absolute time in pre-groove) information
7 with a carrier frequency of approximately 22.05 kHz in terms
8 of the frequency at the 1-times velocity,

9 said carrier frequency is detected while said
10 rewritable disc-shaped optical recording medium is rotated
11 at a constant angular velocity, and a data reference clock
12 according to a disc radius is obtained by multiplying the
13 detected frequency with 196, and

14 an ATIP (abosolute time in pre-groove) signal, which
15 is the ATIP information, is detected, and a data reference
16 clock, which is in synchronism with a synchronization
17 pattern in the detected ATIP signal and a disc rotation,
18 is obtained.

1 34. A recording method according claim 27 or 28,
2 wherein
3 said rewritable disc-shaped optical recording medium
4 has on a substrate a wobble groove that has a wobble signal,
5 whose frequency is modulated by ± 1 kHz according to ATIP
6 information with a carrier frequency of approximately 22.
7 05 kHz in terms of the frequency at the 1-times velocity,
8 and also clock marks arranged along the groove at a repeating
9 frequency in a range of from 2 to 8 times of 22.05 kHz, and
10 the individual clock mark is detected while said
11 rewritable disc-shaped optical recording medium is rotated
12 at a constant angular velocity, and a data reference clock
13 is obtained by multiplying said repeating frequency of the
14 clock mark with a predetermined multiplier.

1 35. A recording method according to claim 27 or 28,
2 wherein
3 said wobble groove has a wobble signal, whose carrier
4 frequency is constant when the linear velocity is constant,
5 and also has address information and a synchronization
6 pattern in terms of whether the wobble is modulated in phase
7 or whether a specified position is devoid of wobble, and
8 said carrier frequency is detected while said
9 rewritable disc-shaped optical recording medium is rotated
10 at a constant angular velocity, and a data reference clock
11 is obtained by multiplying the detected frequency with a

12 predetermined multiplier.

1 36. A recording method according to claim 27 or 28,
2 wherein

3 said rewritable disc-shaped optical recording medium
4 has absolute time information in terms of a sub-code Q
5 channel signal recorded previously in the entire recording
6 area as an EFM-modulated signal, and

7 said EFM-modulated signal is detected while said
8 rewritable disc-shaped optical recording medium is rotated
9 at a constant angular velocity, and a data reference lock
10 and address information are obtained from said EFM-
11 modulated signal.

1 37. A recording method according to claim 27 or 28,
2 wherein

3 said rewritable disc-shaped optical recording medium
4 has a block data structure according to CD-ROM
5 specifications recorded previously in the entire recording
6 area as EFM-modulated signal, and

7 said EFM-modulated signal is detected while said
8 rewritable disc-shaped optical recording medium is rotated
9 at a constant angular velocity, and a data reference clock
10 and address information are obtained from the detected
11 EFM-modulated signal.

1 38. An optical disc recording/retrieving apparatus

2 comprising:

3 a motor for rotating a disc, which has a spiral groove
4 with wobble which carrier frequency is constant in space
5 frequency and meandering according to a signal modulated
6 with a constant carrier frequency f_{L0} and address information
7 and also has a recording layer, at a constant angular
8 velocity with a center of the disc being an axis of rotation,
9 the disc having address information identifying each
10 recording data block, which is a unit of recording
11 information located at a specified position in the spiral
12 groove, and a synchronization pattern identifying a head
13 position of the recording data block;

14 an optical pick-up for generating a focused laser beam
15 irradiating the disc for recording/retrieving;

16 a linear motor for moving said optical pick-up
17 radially of the disc to a given address;

18 a focus servo circuit for focusing the focused laser
19 beam on the recording layer;

20 a groove tracking servo circuit for scanning the
21 spiral groove by the focused laser beam;

22 a detector and decoder circuit for detecting and
23 decoding a carrier frequency f_{A0} , address information and
24 block synchronization signal from the meandering groove
25 geometry;

26 a data-sequence generation circuit for generating a
27 recording data sequence, which is modulated in terms of mark
28 length modulation, in synchronism with a data reference

29 clock T which has a frequency f_{d0} and a start position of
30 the recording block;

31 a laser-power modulation circuit for modulating a
32 recording laser power in accordance with the recording data
33 sequence;

34 a reference signal generator for generating a data
35 reference clock T which varies in reverse proportion to a
36 radius position when the focused laser beam is moved
37 radially of the disc to a given address recording block;
38 and

39 a data-sequence synchronization circuit for
40 synchronizing a data sequence, which is to be written in
41 the given recording block, with the start position of the
42 recording block by comparing in phase between a reference
43 signal f_{R0} , which is obtained by dividing the data reference
44 clock at a particular radius by N (N is an integer), and
45 the carrier frequency f_{A0} , which is detected at the given
46 address from the meandering groove geometry, and also making
47 a fine adjustment of r.p.m. (revolutions per minute) of the
48 disc so as to satisfy a relation $f_{d0} = N \cdot f_{A0}$.

1 39. An optical disc recording/retrieving apparatus
2 according to claim 38, wherein the frequency f_{d0} of the
3 reference clock T at a particular address is varied
4 according to the radius so as to satisfy a relation:

$$5 \quad f_{d0} = f_{ref} + (R - R_{ref}) / \Delta R$$

6 where f_{ref} is the frequency of a data reference clock T_{ref}

7 for a reference radius R_{ref} at the head or tail of the
8 recording area of the optical disc, ΔR is a radial width
9 of the recording medium from an innermost periphery to an
10 outermost periphery, and R is a radius calculated from a
11 given address at which object data is to be recorded.

1 40. An optical disc recording/retrieving apparatus
2 according to claim 38, wherein within a range in which r.p.m.
3 of the disc is adjusted is within $\pm 0.01 \omega_0$ with respect to
4 a reference r.p.m. ω_0 .

1 41. An optical disc recording/retrieving apparatus
2 according to claim 38, wherein the carrier frequency f_{L0} of
3 the flowchart groove geometry is 22.05 kHz, the address
4 information is an ATIP (absolute time in pre-groove) signal
5 whose frequency is modulated by ± 1 kHz with the carrier
6 frequency f_{L0} , and ω_0 is within a range of from 1900 to 2200
7 r.p.m.

1 42. An optical disc recording/retrieving medium
2 wherein recording of data to an information area is made
3 at a constant angular velocity, irrespective of the radial
4 position where the recording takes place.

1 43. An optical disc recording/retrieving method
2 wherein recording and retrieving to and from an information
3 area are made each at a constant angular velocity.

1 44. An optical disc recording/retrieving method
2 wherein recording and retrieving to and from an information
3 area are made at the same angular velocity.

1 45. A rewritable optical recording medium according
2 to claim 1 or 2, wherein

3 an application area includes an application program
4 area occupying a continuous specified part of the
5 application area and storing a predetermined application
6 program, and a user data area which occupies the remaining
7 portion of the application area and in which the user data
8 relating to at least the application program is adapted to
9 be recorded; and

10 retrieving of the application program and recording
11 of the user data relating to the application program are
12 made each at a constant angular velocity.

1 46. A rewritable optical recording medium according
2 to claim 45, wherein the application program and the user
3 data are recorded in fixed-length packet units each having
4 a common file management structure for both the application
5 program and the user data.

1 47. A recording/retrieving apparatus for performing
2 recording and retrieving on a rewritable optical recording
3 medium having an application ar a that includes an

4 application program area occupying a continuous specified
5 part of the application area and storing a predetermined
6 application program, and a user data area which occupies
7 the remaining portion of the application area and in which
8 user data relating to at least the application program is
9 adapted to be recorded, the application program and the user
10 data being recorded in fixed-length packet units each having
11 a common file management structure for both the application
12 program and the user data, and retrieving of the application
13 program and recording of the user data relating to the
14 application program being made each at a constant angular
15 velocity (CAV), said apparatus comprising:

16 program executing means for executing the application
17 program content by having access to the specified part of
18 the application program in the rewritable optical recording
19 medium to retrieve the application program data with keeping
20 the medium, which is in the form of a disc, in CAV rotation
21 at a first predetermined angular velocity;

22 information input means for inputting necessary
23 information according to the application program to be
24 executed by said program executing means; and

25 recording means for having access to the user data area
26 with keeping the disc in CAV rotation at a second
27 predetermined angular velocity and for recording in the user
28 data area the necessary information, which is inputted by
29 said information input means, as user data.

1 48. A recording/retrieving apparatus according to
2 claim 47, further comprising information input offer means
3 for retrieving a predetermined demonstration, during the
4 execution of the application program, to offer whether the
5 user should make information input in response to the
6 demonstration.